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Effect of Fungal Infections on Nutritional Value of Papaya, Guava and Lemon Fruits

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ABSTRACT
When it comes to fruit nutrition, the quality and quantity of nutritious components are the most important factors to consider. In the current experiment, fungi from papaya, guava, and lemon fruits were examined to see whether they induce significant biochemical changes that affect the quality of the fruit. Inflectional changes revealed that the quality of various sugars had been reduced in the impacted fruits when they were analyzed postharvest. This could have been caused by the breakdown of complex carbohydrates into simple sugars in the afflicted fruits. A comparison of infected and healthy fruits was made based on the nitrogen content, non-reducing sugars content, protein content, total free amino acids content, ascorbic acid content, total sugars content, total phenols content, and total ash content. Because fungal pathogens that cause post-harvest fungal infection of fruits and vegetables produce mycotoxins, which are toxic to both humans and animals, post-harvest diseases in fruits and vegetables are a serious problem that results in the loss of a large percentage of crops, sometimes as much as 50% in some fruits and vegetables. The purpose of this study is to evaluate the post-purchase storage of commonly consumed fruits and to determine the fungal strains that are responsible for their spoilage.
Keywords: biochemical,nutrition, quality, mycotoxins, carbohydrates

INTRODUCTION:

Papaya is a popular tropical fruit with a thriving commercial market. Many nutrients in fruits include vitamins A and C. Papayas are usually consumed raw or in fruit salads, juices, or canned papaya cubes. Postharvest losses due to fungus are considerable in papayas. Raymond and Ishaku (1989) estimated post-harvest losses of tropical fruits in Nigeria at 25% of production.Papain, derived from the immature fruits of the papaya plant, is used in cosmetics, meat tenderization, chewing gum manufacture, and other applications. The enzyme papain, found in many fruits, aids in protein digestion. Green fruit juice is used by Andhra Pradesh natives to cure diabetes. They make fruit candies, jams, marmalades, and nonalcoholic beverages.Gloeosporium papaya and C. papaya were shown to be the cause of papaya fruit rot by Srivastava and colleagues in 1964. Ripening fruits were attacked, according to Srivastava and Tandon (1971), resulting in high postharvest storage losses.Guava is a tropical fruit that can be cultivated in a wide range of climates. Guava contains low calories and is high in fibre, potassium, and vitamins A, B, and C. Guava is rich in iron.Due to its powerful aroma, it is usually eaten whole or cut into slices and sprinkled with sugar or salt. Boiled guava is commonly used to make candies, jelly, jam, and beverages in addition to being a preservative.Guava post-harvest infections can typically be tracked back to the orchard where it was initially identified, according to Srivastava et al. (1964). The occurrence of numerous prevalent postharvest guava diseases, such as Aspergillus niger, Botryodiplodia theobromae, and Pestalotia psidii, in the soil profiles of guava farms was examined by Pandey et al. (1991).Citrus trees, unlike other trees, have prickly, fragrant leaves with leathery, evergreen leaves covered with glandular

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trichomes. The flesh is extremely juicy, with many fluid sacs scattered throughout.The acids in juice have been found to prevent bacteria from growing in food that has been left out at a high temperature for an extended period of time.Lemon rind, peeled or shredded, has a distinct flavour and is commonly used in cooking and brewing.Lemonade is prepared from lemon juice and is also used as a cocktail mixer.Citrus oil, pectin, and citric acid are among the many components contained in the pulp left behind following commercial juice extraction. Lemon is used in a wide range of industries, including culinary, cosmetics, and pharmaceuticals.Srivastava (1966) found that the circumstances for Citrus sinensis (sweet orange) were similar to those for lemon fruits. Aspergillus rot is quite common in lime fruits, as previously mentioned (Bhargava,1983). In all citrus-growing countries, P. digitatum is to blame for the spread of green mould infections.

MATERIALS AND METHODS

Infected papaya, guava, and lemon fruit samples were collected in clean polythene bags from various places and transported to the laboratory, where they were swabbed in 70% ethanol for 1 minute, washed with sterilised distilled water multiple times, and blotted dry using sterile filter sheets. Spots, rots, and the level of tissue damage in fruits were meticulously measured. Isolations of contaminated fruits were prepared on PDA medium in 9cm petriplates and cultured for five days at 28°C. Pure culture formed from developing mycelial colonies was kept on a PDA slant and afterwards identified by morphological examination, using Gilman (1971); Smith (1960); Tilak (1998) and other standard literature as references. Koch's postulates were used to test the pathogenicity of several fungi isolated from infected papaya, guava, and lemon fruits in the lab.

Biochemical changes in infected fruits

Ripe fruits of uniform size were washed in distilled water and found to be healthy and apparently unharmed. 95 percent alcohol was used to sterilise the surface, which was then dried in the air. A mycelial disc cut from a pure culture of the virus grown on PDA was used to infect the fruits at the stylar end. Fruits that had been inoculated were kept at 25°C for 7 days.Healthy fruits that had not been inoculated served as a control. Nitrogen, protein, total sugar, reducing sugar, total free amino acids, non-reducing sugar, and ash content were all evaluated in the healthy and infected fruits.

1. The protein percent in g/100g of the sample was calculated by multiplying the total nitrogen content of the sample by 6.25 using the MicrokjedahTs technique.
2. Jayaraman's (1984)approach was used to calculate free amino acids.
3. The experiments were carried out using Sadashivam and Manikkam's (1992) approach for the quantitative determination of total phenol.
4. The method given by Sadasivam and Manickam(1992) was used to calculate ascorbic acid levels.
5. Changes in total sugars and reducing sugars were assessed using the procedures provided by Sadashivam and Manikkam (1992).
6. Subtract the value of reducing sugar from the total sugar and multiply the result by the factor 0.95 to get the amount of non-reducing sugar.
7. The ash content was calculated using Hart and Fisher's technique (1971).

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RESULTS

The results are represented in tabular format

Table-1: Biochemical changes in infected papaya fruits.

Fungal Pathogens	Nitrogen(%)		Protein (%)		Total sugar(%)		Ascorbic acid(%)		Total phenol(%)		Reducing sugars(%)		Non reducing sugars(%)		Total free aminoacid(%)		Total ash(%)	
	I	H	I	H	I	H	I	H	I	H	I	H	I	H	I	H	I	H
C.papaya	0.25	1.20	1.65	2.64	5.00	10.15	9.25	12.15	1.70	1.40	5.05	9.51	5.80	4.35	5.21	2.82	0.6	1.15
A.flavus	0.24	1.24	1.34	2.66	5.35	10.18	8.00	12.36	1.75	1.60	7.82	9.62	6.15	4.60	5.36	3.19	0.94	1.14
Rhizopus stolonifer	0.25	1.26	1.25	2.25	5.48	10.21	10.27	12.24	3.64	1.68	4.46	8.64	5.32	3.87	5.34	4.00	4.00	1.16

Table-2: Biochemical changes in infected guava fruits.

Fungal Pathogens	Nitrogen(%)		Protein (%)		Total sugar(%)		Ascorbic acid(%)		Total phenol(%)		Reducing sugars(%)		Non reducing sugars(%)		Total free aminoacid(%)		Total ash(%)	
	I	H	I	H	I	H	I	H	I	H	I	H	I	H	I	H	I	H
B.theobromae	0.22	0.44	1.65	2.25	5.5	10.8	9.6	10.6	1.66	2.50	6.52	8.32	1.60	3.24	9.44	6.35	0.73	1.10
Colletotrichum sp	0.28	0.44	1.10	2.25	7.5	10.8	9.4	10.6	3.67	2.54	6.54	8.32	1.44	3.24	8.66	6.35	0.72	1.10
Aspergillus niger	0.20	0.44	1.65	2.25	5.5	10.8	9.6	10.6	1.66	2.54	6.52	8.32	4.60	3.24	4.35	6.35	0.73	1.10

Table-3: Biochemical changes in infected lemon fruits.

Fungal Pathogens	Nitrogen(%)		Protein (%)		Total sugar(%)		Ascorbic acid(%)		Total phenol(%)		Reducing sugars(%)		Non reducing sugars(%)		Total free aminoacid(%)		Total ash(%)	
	I	H	I	H	I	H	I	H	I	H	I	H	I	H	I	H	I	H
A.niger	0.16	0.34	1.75	2.48	6.08	9.4	11.4	17.4	2.5	1.8	4.45	7.45	5.25	5.35	5.14	2.15	0.30	1.50
Penicillium digitatum	0.18	0.30	1.46	2.44	4.6	9.7	10.8	11.6	1.6	1.4	3.35	6.84	5.24	4.16	4.84	2.36	0.14	1.35
Rhizopus sp	0.15	0.32	1.66	2.46	6.10	9.6	11.6	16.6	2.8	1.6	4.12	7.26	4.28	5.20	5.54	2.14	0.15	1.42

DISCUSSION ON TABLES:

During the course of the investigation, sick fruits were collected from the local market during their distinct seasons. At various stages of the disease's progression, the symptoms were thoroughly investigated. *Penicillium*, *Aspergillus*, *Rhizopus*, and *Colletotrichum* were among the postharvest fruit rot pathogens recovered from papaya, guava, and lemon. To test their efficiency, the fruit rot-

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causing fungal infections were isolated from their respective damaged fruits and cultured on various nutritional conditions.

Papaya: According to table-1, ascorbic acid and reducing sugar levels were lower, but total ash content was higher. The overall protein level in the body was also increased. The body's total phenol and amino acid levels have dropped substantially. *C.papaya* infection resulted in considerable reductions in nitrogen, protein, and total sugar levels. *Gleosporium* papaya and *Colletotrichum* papaya were identified by Srivastava and colleagues in 1964.The biochemical contents of *A.flavus* were determined after it was injected into papaya fruit, and the results are shown in table-1. The quantities of ascorbic acids, reducing sugars, total ash, and protein were all found to be lower. Total phenols and amino acids levels increased. *R.stolonifer* infection also reduced nitrogen, protein, and total sugar levels.Ghosh et al. (1966) investigated at the depletion of ascorbic acid in infected papaya fruit tissue.According to Tandon (1967), the free amino acids of healthy papaya fruits and those infected with *Gloeosporium* papaya and *Rhizopus stolonifer* were discovered to contain aspartic acid, glutamic acid, serine, glycine, asparagine, alanine, and arginine, whereas the infected fruits contained arginine and arginine.According to Ghosh et al. (1967), the sugar content of freshly selected papaya fruits infected with *Colletotrichum* papaya and *G. papayae* rapidly decreases when the fruit is just ripe.

Guava: The guava fruit showed post-infectional changes, as shown in table-2. As a result of *B.theobromae*, the protein and sugar content of the fruits has decreased. There is a significant increase in phenol and total free amino acids after infection. A study conducted by Tandon, R. N. (1967) in guava fruit revealed quantitative and qualitative differences in free and bound amino acids between healthy and diseased fruits.Total ash and sugar levels were lower in all of the cultivars evaluated.The amount of ascorbic acid, carbs, and protein in guava fruits infected with *Colletotrichum sp*. was found to be significantly decreased, although total free amino acids rose drastically. Both the overall ash content and the level of reducing sugar were lowered. Infection with *Colletotrichum sp*. increased total phenol concentration in all cultivars.Total sugar levels were decreased *in A.niger*-infected guava fruits. Infected guava cultivars had lower nitrogen, protein, and total ash levels. The total amount of phenol in the body has increased. Lowering sugar and non-reducing sugar levels were found to be lower in all infected Guava cultivars.According to Pandey et al. (1991), the incidence of various prevalent postharvest guava pathogens in the soil profiles of guava plantations, such as *Aspergillus niger*, *Botryodiplodia theobromae*, and *Pestalotia psidii*, was investigated.According to Srivastava et al. (1964), the post-harvest infections of guava may often be traced back to the orchard where it was first discovered. Guava postharvest illness can frequently be traced back to the orchards where it first appeared (Srivastava et al.,1964). As previously documented, *A.niger, C.gleosporioides, Pestalotia psidii*, and *P.expansum* are among the fungi that have been shown to be connected with the decomposition of guava fruits, and they are crucial (Ramaswami et.al.1984, Choube and Pundhir,2005).

Lemon: The biochemical changes that occur in fruits as a result of *A.niger* infection are shown in Table 3. Infected fruits included lower levels of nitrogen, protein, total sugar, reducing sugar, Ascorbic acid, and total ash, although all lemon cultivars contained higher levels of total phenol and total free amino acids than non-infected fruits did.The nitrogen content, protein, total sugar, total ash, and reducing sugar in lemon fruits were all reduced as a result of *Penicillium digitalum* pathogenesis.

Total free amino acid, non-reducing sugar, and total phenol were all higher.In the current investigation, total sugar levels in infected lemon fruits with *R.stolonifer, P.digitatum* were shown to be lower. The amount of total free amino acids and total phenols in the fruit increased considerably during the infection phase. The amount of nitrogen, protein, and total ash in the soil has all reduced.Singh and Sinha (1982) discovered that the bacteria *A.jlavus* and *A.parasiticus* cause total sugar depletion as well as reducing and non-reducing sugar depletion in the *Citrus sinensis* fruit.Srivastava (1966) found that the circumstances for *Citrus sinensis* (sweet orange) were similar to those for lemon fruits.Bhargava (1983) looked at the fungal infection *Aspergillus* rot, which affects lime fruits. Banana fruits infected with the virus, on the other hand, had a significant rise in total phenols (Sawant and Gawai, 2011). The increase in phenol content of all apple, banana, guava, lemon, mango, and papaya varieties was initially thought to be due to fungal infection of all test fungi, but this was later validated by additional testing.*A.niger*, a fungal pathogen that causes black mould rot in lemons, was identified from the fruits. *Aspergillus* rot is quite common in lime fruits, as previously mentioned (Bhargava,1983). In all citrus-growing countries, *P. digitatum* is to blame for the spread of green mould infections.

CONCLUSION

When it comes to fruit nutrition, the quality and quantity of nutritious components are the most important factors to consider. Because the fungus absorbed some of the stored compounds and converted others into simpler substances, they had an impact on the stored substances. The amount of various free and bound amino acids and organic acids is altered, and a steady decline in the amount of sugar and vitamin C is noticed as the disease progresses, indicating that the disease is progressing. Different types of fungi are responsible for rotting papaya, guava, and lemon fruit. Premature postharvest losses of fruits are quite substantial, and a variety of post-infectional biochemical alterations significantly reduce their food and commercial value. According to the findings of the study, a fungal infection caused nutritional variations in fruits and vegetables.

REFERENCES

1. Bhargava, S.N. and Arya, A.(1983). In recent advances in Plant pathology (Eds. Akhtar Hussain et.al,) Print House (India) Lucknow. 87-96.
2. Choube H.S. and Pundhir V.S.(2005). Crop diseases and their management.Prentice-Hall ofIndia Pvt. Ltd, New Delhi,India.pp641-642.
3. Ghosh, A.K.and Tandon, R.N.(1967). Utilization of alcohols by some anthracnose fungi. Pathological. Microbiologia. 30:64-70.
4. Ghosh,A.K. ; Tandon,R.N.; Bilgrami, K.S. and Srivastava, M.P.,('1964). Studies on fungal diseases of some important pathogens. Proc.Natl.Acad.Sci.India.35B: 393-398.
5. Gilman, J.C. (1971). A manual of soil Fungi, 2nd edn, Iowa. State College Press, Ames, Iowa, pp.450.
6. Hart, D.L. and Fisher, H.J. (1971). Modern food analysis. Springler-Verlarg, New Delhi.
7. Ishaku, B. C. (1989). Two post-harvest fungal infection of the carica papaya. Fruits in Ibadan. M.Sc. dissertation, University of Ibadan, Nigeria.
8. Jayaraman, J. (1984). Laboratory Manual of Biochemistry. Willey Eastern Ltd. New Delhi.

9. Pandey, R.R., Chaturvedi, A.P. and Dwivedi, R.S.(1991). Ecology of microfungi in soil profiles of Guava orchard with reference to edaphic factors. Proc. Natl. Acad.Sci.India.61B: 97-107.
10. Ramaswami, G.K.; Sohi, H.S. and Govinda, H.C.(1984). Studies on spore germination in Pestalotia psidii, the causal organism of guava canker. Indian J.Mycol. Plant Pathol. 14: 289.
11. Raymond, W. D. (1966). The importance of moulds on the deterioration of Tropical food and feeding stuffs. SCI Monograph No. 23, pp: 21-30.
12. Sadasivam, S. and Manickam, A. (1992). Biochemical methods for agricultural sciences. Willey Eastern Ltd.
13. Sawant, S.G. and Gawai, D.U.(2011). Biochemical changes in Banana fruits due to postharvest fungal pathogens.Current Botany, 2(1): 41-42.
14. Singh Anjana and Sinha, K.K. 1982. Biochemical changes in musambi fruits inoculated with species of aflatoxin producing Aspergilli. Curr. Sci. 51:841-842.
15. Smith, G. (1960). Industrial microbiology; Fungi; Industrial applications. 5th edn. Arnold, London, pp.399.
16. Srivastava, M.P. and Tandon, R.N. (1966). Some pathological studies on Botryodiplodia theobromae. Patxausing Banana rot. Mycopath. Mycol. Appl.29:245-253.
17. Srivastava, M.P. and Tandon, R.N. (1971). Postharvest diseases of banana in India. Indian Phytopath.24: 115-118.
18. Srivastava, M.P.; Tandon, R.N.,; Bhargava, S.N. and Ghosh, A.K. (1965). Studies on fungal diseases of some tropical fruits. Ill Some postharvest diseases ofMango(Mangifera indica).L. Proc. Natl. Acad. Sci. India 35 B : 69-75.
19. Tilak ,S.T. (1998). Aerobiology, Satyajeet Prakashan. Pune, India,pp.504.